

TABLE 4.—Mean altitudes and temperatures of significant points identifiable as tropopause during February 1940, classified according to the potential temperatures (10° intervals between 290° and 409° A) with which they are identified (based on radiosonde observations)—Continued

Potential temperatures, °A	Miami, Fla.			Minneapolis, Minn.			Nashville, Tenn.			Oakland, Calif.			Oklahoma City, Okla.			Omaha, Neb.			Pensacola, Fla.		
	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.
290-299				3	7.2	-49.0	1	6.2	-41.0												
300-309				6	8.6	-54.3	1	7.7	-42.0	2	7.7	-44.0	3	8.0	-45.7	3	8.0	-49.3			
310-319	1	7.0	-30.0	19	9.6	-57.5	15	8.9	-48.0	17	9.1	-50.1	21	9.0	-49.4	26	9.6	-55.7	5	8.0	-41.2
320-329	4	10.2	-51.2	11	10.4	-58.9	19	10.6	-56.4	24	10.6	-57.0	17	10.5	-57.4	19	10.8	-60.8	5	9.7	-46.0
330-339	15	11.2	-53.0	3	10.9	-57.3	19	11.6	-60.8	14	12.0	-64.9	14	11.3	-58.1	4	11.4	-62.0	8	11.2	-54.4
340-349	18	12.8	-60.8				1	11.6	-57.0	6	12.1	-59.7	4	12.0	-58.8	1	12.9	-68.0	6	12.3	-59.8
350-359	3	13.6	-64.3				1	12.2	-56.0	2	12.8	-61.0	1	11.8	-52.0				1	13.0	-61.0
360-369	6	14.9	-70.2				1	13.7	-63.0										2	14.3	-66.0
370-379	7	15.6	-72.9							2	13.8	-57.5	3	14.2	-61.7	1	14.1	-60.0	2	14.9	-64.5
380-389	10	16.4	-74.9	1	14.2	-56.0	1	13.5	-54.0				2	15.1	-63.0	1	14.6	-61.0			
390-399	5	16.8	-74.8	2	14.2	-53.5	1	15.7	-63.0	6	15.2	-62.0							1	16.5	-70.0
400-409	10	17.4	-75.6				2	15.6	-60.0	2	16.2	-64.5	2	15.8	-60.5	1	15.3	-57.0	1	16.9	-68.0
Weighted means		14.0	-64.9		9.9	-56.6		10.6	-54.6		11.2	-57.5		10.7	-55.0		10.4	-57.9		11.5	-54.5
Mean potential temperature °A. (weighted)	365.6			320.4			330.5			334.9			330.5			323.1			341.3		

Potential temperatures, °A.	Phoenix, Ariz.			San Antonio, Tex.			San Diego, Calif.			Sault Ste. Marie, Mich.			Spokane, Wash.			St. Louis, Mo.			Washington, D. C.		
	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.	Number of cases	Mean altitude (km.) m. s. l.	Mean temperature °C.
290-299										7	6.8	-46.6	3	8.1	-55.0						
300-309	3	7.5	-42.3							14	8.1	-52.4	19	8.4	-52.3	3	8.1	-51.0	5	8.3	-50.4
310-319	8	9.2	-49.5	4	8.4	-43.2	4	8.4	-38.2	31	9.5	-57.7	17	9.6	-57.4	11	9.6	-55.7	7	9.0	-50.6
320-329	20	10.4	-55.1	18	10.0	-49.3	13	10.5	-55.5	12	10.6	-61.4	10	10.6	-59.6	26	10.5	-57.6	12	10.5	-58.6
330-339	11	11.9	-61.5	19	11.0	-52.9	7	11.0	-54.0				2	11.6	-64.0	6	11.6	-62.2	3	11.6	-60.7
340-349	6	12.5	-61.5	7	12.5	-59.9	8	12.1	-58.4	1	11.4	-53.0				2	12.3	-60.0			
350-359	1	12.2	-56.0	5	12.9	-60.2	2	13.2	-63.0							1	12.9	-61.0			
360-369				4	14.2	-65.5	1	13.7	-64.0												
370-379	1	13.7	-61.0	5	15.1	-68.4	1	14.8	-65.0	1	12.7	-52.0				4	14.2	-61.2			
380-389	1	15.7	-67.0	3	15.0	-62.0	1	15.1	-66.0							1	14.8	-62.0			
390-399				7	16.2	-68.4	1	16.1	-70.0							2	15.4	-63.0			
400-409	1	16.9	-70.0	2	17.0	-71.0							1	14.8	-55.0	4	15.6	-62.0	1	15.3	-60.0
Weighted means		10.9	-56.2		12.2	-56.7		11.3	-55.5		9.2	-55.9		9.4	-56.0		11.2	-58.3		10.6	-55.4
Mean potential temperature °A. (weighted)	330.6			347.4			336.6			312.9			314.4			336.0			322.8		

RIVERS AND FLOODS

(River and Flood Division, MERRILL BERNARD in charge)

By BENNETT SWENSON

The precipitation during February was generally above the average over most of the country and decidedly so from the Rocky Mountains westward, except in parts of the far Southwest. It was also well above the normal in much of the Gulf States and over the Ohio Valley northeastward to the interior of New England. The precipitation from western Pennsylvania northeastward was largely in the form of snow. Temperatures averaged below normal in the South Atlantic area and in all sections south of the Ohio River although departures were not marked. In all other sections of the country the temperatures were higher than normal.

Atlantic slope drainage.—Considerable precipitation, mainly in the form of snow, added to the existent snow cover during the month over much of the area from western Pennsylvania northeastward into the interior of New England. There were two outstanding storms, February 14 and 19 which deposited most of the snow over the above-mentioned area.

Over the Susquehanna Basin mild weather during much of the month resulted in a considerable reduction of the ice thickness in the streams and of the snow depth particularly in the lower portions. Surveys made near the

end of February indicate that the snow depth averaged 16.6 inches over the upper basin above Towanda, Pa., and 9.4 inches in the basin at and below Towanda. The maximum depth was 36 inches at Worcester, N. Y., and the minimum was no snow at several points in the lower basin. No flooding or any appreciable rises occurred, but the snow cover continued as a serious flood threat.

Rises, accompanied by minor flooding at a few places, occurred in the streams of the Atlantic drainage from the James River southward. These resulted from moderately heavy rains on the 13th and again on the 19th. No appreciable damage was reported.

East Gulf of Mexico drainage.—Heavy rains on the 5th, 13th, and 17th of the month over much of this area caused rises in most of the streams with some flooding.

The Apalachicola River crested at 20.9 feet at Blountstown, Fla. (flood stage 15 feet), on February 22. A rapid rise to slightly above flood stage occurred at Newton, Ala., on the upper Choctawhatchee River and a slower rise to slightly above flood stage at Caryville, Fla., on the lower reaches during the period February 19 to 22. At Centerville, Ala. (flood stage 23 feet), on the Cahaba River two crests occurred, 27 feet on the 6th and 25.3

feet on the 19th. Heavy rains on February 5 and 6 over the Black Warrior watershed and that of the Tombigbee south of Columbus, Miss., caused some flooding in the former stream from Tuscaloosa, Ala., southward and, in the latter from Demopolis, Ala., southward. Slight flooding also occurred in the Pearl and Pascagoula Rivers. The losses from these floods as shown in the table below were only slight or moderate.

Mississippi River system.—The stages during the month were, as a rule, unusually low except in portions of the Ohio watershed where some flooding took place. At Omaha, Nebr., the Missouri River reached its lowest February stage of record, 2.1 feet on the 29th. The river stage at St. Louis, Mo., was continuously below zero on the gage from September 19, 1939, to March 3, 1940, inclusive, which is the longest period of continuous sub-zero gage readings of record (1861 to date). The previous longest period was from September 7, 1937, to January 25, 1938, inclusive. In the lower Mississippi, sub-zero stages persisted at Vicksburg, Miss., from September 8, 1939, to February 19, 1940, which has never been equalled previously for duration. The low stages at Greenville, Miss., —5.9 feet, February 1, and at Vicksburg, Miss., —6.95 feet, February 3, are the lowest stages of record at those points. Following are a number of low stages during the past fall and winter resulting from drought conditions in the Mississippi watersheds:

River and station	Lowest stage, fall and winter, 1939-40	Previous lowest stage and date
MISSOURI RIVER		
Kansas City, Mo. ¹	0.4, Jan. 9	—2.7, Jan. 9, 1937.
ARKANSAS RIVER		
Little Rock, Ark.	—1.9, Oct. 22 ¹	—4.2, Aug. 22, 1934.
RED RIVER		
Shreveport, La.	0.2, Nov. 8, 9	1.7, Sept. 13, 1936.
MISSISSIPPI RIVER		
Keokuk, Iowa	—3.4, Dec. 31, Jan. 2	—4.3, Jan. 3, 1934.
St. Louis, Mo.	—6.1, Jan. 16	—5.5, Dec. 12, 1937.
Memphis, Tenn.	—0.6, Oct. 25, 28	—2.7, Nov. 9, 1895.
Greenville, Miss.	—5.9, Feb. 1	—4.2, Aug. 27, 1936.
Vicksburg, Miss.	—6.95, Feb. 3	—6.5, Nov. 13, 1895.

¹ Ice reading.

² And later dates.

Streams were generally frozen in northern sections, and floating ice was observed during the month in the Mississippi River as far south as White Castle, La., and in the Atchafalaya River, from the Mississippi, at Simmesport, La. Medium to heavy ice which reached Helena, Ark., on January 23, formed a gorge at that point on the 30th. The gorge moved out on February 4 and on the 6th the river was practically clear of ice and open to navigation.

Flood stage was exceeded at Parkers Landing, Pa., on the Allegheny River, where the water was backed up by an ice jam a short distance below that gage. The following report was submitted by the official in charge, Pittsburgh, Pa.:

A small ice jam formed in the Allegheny River at West Monterey, Pa., about 5 miles downstream from Parkers Landing on January 11, when ice from the upper river came down. This gorged ice held the river stage at Parkers Landing at a 10- to 14-foot stage during the remainder of January and the early part of February. Light to moderate rainfall and mild weather of February 10 and 11 brought some of the ice from the upper river out again, and piled it on top of the gorged ice below Parkers Landing, which by this time was frozen solid to a considerable depth. The additional ice closed the passages through the gorge, and quickly raised the water to a 24.4-foot stage at Parkers Landing.

At 5 p. m. of February 12, the stage was 14 feet, and by 8:30 p. m. the stage was 24.4 feet. The water and heavy cakes of ice covered

the highway from the Highway Bridge at the upper end of the town to the lower end of the town a distance of about one-half mile. At the Parker end of the bridge, the ice was forced over the top of the guard rail, and completely closed the entrance to the bridge with ice as high as the rail. Water covered the first floors of most of the buildings in the town along the highway, and of the glass factory near the bridge. By midnight of the 12th the water had receded to 22.3 feet, leaving the entrance to the bridge and the highway covered with ice. From the 12th to the 16th the water level fluctuated each day around the 22-foot stage, dropping below 20 feet about 4:30 a. m. of the 16th.

Considering the high stage reached, the damage caused by the high water was small, due to the fact that it occurred in only a short stretch of the river, that practically everything that could be moved was raised up out of reach of the water. Telephone and telegraph lines were out of service for several hours during the night of February 12. The greatest item of expense was the cleaning up after the water receded, and removing the heavy ice from the highway in the town of Parkers Landing. The estimated total damage is \$300.

At the end of the month there was considerable snow in the mountains and the northern portions of the Allegheny Basin, ranging in depth from 12 to 30 inches, while in the lowlands of the same basin the depths ranged from 3 to 7 inches. Over the lower 50 miles of the Monongahela the greater portion of the ground was covered with snow from an inch to several feet in depth. This snow was of high water content equivalent to 3 or 4 inches of water. On the upper Youghiogheny, in higher elevations, there was considerable snow, but in the Tygart and West Fork Basins in West Virginia the snow was negligible.

Ice continued in the Ohio River until about the 13th when navigation, which had been suspended since January 18, was resumed. A moderate rise occurred in the lower reaches on February 11 but did not reach flood stage.

Pacific slope drainage.—Kings River reached flood stage for a short time on February 26 and moderately high stages continued in all streams of the southern San Joaquin Basin during the remainder of the month. No damage occurred although excess waters emptying into Tulare Basin threatened levees of some reclaimed areas. At mountain stations in this area the February precipitation was slightly more than twice the February normal and at most points the seasonal total to the end of February was above normal for the entire season.

In the Sacramento River Basin proper frequent heavy rains during the month kept the streams at high levels, developing into a flood of great proportions at the close of the month. A report will be made on this flood at a later date.

TABLE OF ESTIMATED FLOOD LOSSES

Drainage and river	Tangible property	Matured crops	Prospective crops	Live-stock and other movable farm property	Suspension of business	Total
Atlantic slope drainage: Savannah River					\$500	\$500
East Gulf of Mexico drainage:						
Apalachicola River				\$350	1,800	2,150
Choctawhatchee River	\$12,000	\$3,500		1,000	2,000	18,500
Tombigbee River	2,200		\$750	500		3,400
Pearl and Pascagoula Rivers	250				3,000	3,250
Ohio River Basin: Allegheny River	300					300
Pacific slope drainage: Eel River	455,000	500	20,000	1,000	10,000	486,500

One of the three greatest floods of record occurred in the Eel River Delta from February 27 to 29 as the result of heavy rains during the night of the 26th. At Dos Rios, Calif., the river rose 30 feet in 24 hours to a stage of 38.9 feet at 8 a. m. on the 27th and to 45.4 feet in the next 24 hours. A crest stage of 24.4 feet was reached at Fern-

bridge, Calif., on February 28, within a few inches of that established in the flood of December 1937. Considerable damage resulted.

Flooding of bottom lands occurred in some of the tributaries of the Willamette River in Oregon from February 6 to 29 but no material damage resulted.

FLOOD-STAGE REPORT FOR THE MONTH OF FEBRUARY 1940

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
James:	<i>Feet</i>			<i>Feet</i>	
Columbia, Va.	10	{ 12	14	11.4	13
State Farm, Va.	12	{ 18	23	14.4	19
Roanoke:		{ 11	11	13.0	12
Weldon, N. C.	31	{ 21	22	32.1	21
Williamston, N. C.	10	{ 12	(1)	11.0	17, 18, 28
Neuse:					
Neuse, N. C.	14	{ 8	10	14.9	9
Smithfield, N. C.	13	{ 8	11	14.0	10-11
Cape Fear: Lock 2, Elizabethtown, N. C.	20	{ 8	13	26.0	9
Saluda: Pelzer, S. C.	6	{ 20	22	20.9	21
Santee:		{ 18	20	6.8	19
Rimini, S. C.	12	{ 21	25	13.4	22-23
Ferguson, S. C.	12	{ 23	26	12.5	25
Ogeechee: Dover, Ga.	7	{ 20	23	7.1	21-23
Savannah:					
Butler Creek, Ga.	21	{ 19	21	23.2	20
Clyo, Ga.	11	{ 17	(1)	15.9	28
Ocmulgee: Abbeville, Ga.	11	{ 21	28	11.8	26
Oconee: Milledgeville, Ga.	20	{ 19	20	20.8	20
Altamaha: Charlotte, Ga.	12	{ 18	(1)	15.1	29
EAST GULF OF MEXICO DRAINAGE					
Flint: Albany, Ga.	20	{ 21	21	20.1	21
Apalachicola: Blountstown, Fla.	15	{ 17	Mar. 3	20.9	22
Choctawhatchee:					
Newton, Ala.	19	{ 19	19	19.8	19
Caryville, Fla.	12	{ 19	24	12.9	22
Cahaba: Centerville, Ala.	23	{ 6	7	27.0	6
Black Warrior:		{ 18	19	25.3	19
Lock No. 10, Tuscaloosa, Ala.	46	{ 6	8	55.5	6
		{ 10	11	48.0	10
		{ 19	20	48.2	19
Lock No. 7, Eutaw, Ala.	35	{ 7	18	45.9	13
		{ 19	25	41.8	22
Tombigbee:					
Lock No. 4, Demopolis, Ala.	39	{ 7	28	50.9	14
Lock No. 3, Whitfield, Ala.	33	{ 6	(1)	52.9	14-15
Lock No. 2, Pennington, Ala.	46	{ 8	(1)	54.0	18-19
Lock No. 1, Alabama.	31	{ 9	(1)	36.7	19-21

FLOOD-STAGE REPORT FOR THE MONTH OF FEBRUARY 1940—Continued

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
EAST GULF OF MEXICO DRAINAGE—continued					
Chickasawhay: Shubuta, Miss.	<i>Feet</i> 26	10	11	<i>Feet</i> 26.6	11
Pascagoula: Merrill, Miss.	22	12	16	22.4	14, 15
Pearl:					
Jackson, Miss.	18	9	29	23.3	19
Pearl River, La.	12	10	(1)	15.0	13
MISSISSIPPI SYSTEM					
Ohio Basin					
Allegheny: Parkers Landing, Pa.	20	13	15	24.4	12
Lower Mississippi Basin					
Coldwater: Coldwater, Miss.	13	{ 10 18	12 21	13.4 13.5	11 20
PACIFIC SLOPE DRAINAGE					
San Joaquin Basin					
Kings: Piedra, Calif.	10	26	26	10.5	26
Mokelumne: Bensons Ferry, Calif.	12	28	(1)		
Sacramento Basin					
Stony Creek: St. John, Calif.	12	28	28	13.9	28
North Fork: Colgate, Calif.	14	27	28	14.8	27-28
Feather:					
Oroville, Calif.	25	27	28	25.1	28
Nicolaus, Calif.	25	28	(1)	26.3	29
Sacramento:					
Kennett, Calif.	25	27	29	36.3	28
Red Bluff, Calif.	23	27	(1)	32.2	28
Hamilton City, Calif.	22	28	29	22.6	29
Knights Landing, Calif.	30	28	(1)	33.5	29
Humboldt Bay Basin					
Eel: Fernbridge, Calif.	17.5	27	(1)	24.4	28
Columbia Basin					
Long Tom: Monroe, Oreg.	12	{ 6 19 27	10 19 (1)	13.0 12.0 13.1	8 19 29
		6	7	11.5	7
Santiam: Jefferson, Oreg.	10	26	26	10.0	26
		29	29	10.4	29
South Yamhill: Willamina, Oreg.	8	5	7	10.7	6

¹ Continued at end of month.

WEATHER ON THE ATLANTIC AND PACIFIC OCEANS

[The Marine Division, I. R. TANNERHILL in charge]

NORTH ATLANTIC OCEAN, FEBRUARY 1940

By J. H. GALLENGE

Atmospheric pressure.—Mean monthly pressures for February 1940 show negative departures from normal over practically all ocean areas from which reports were received, with the exception of Reykjavik, Iceland, where a positive departure of 9.9 millibars (0.29 inch) was noted. Average pressure values were highest over and adjacent to the Gulf of Mexico, diminishing off to the north-northeast, where the lowest value, 996.5 millibars (29.42 inches), was observed at Julianehaab, Greenland.

The pressure extremes noted from vessel reports were 1,033.2 millibars (30.51 inches) and 958 millibars (28.29 inches). The highest was observed on the American steamship *Excambion*, during the forenoon of the 17th, near latitude 36° N. and longitude 12° W., while the lowest, 958 millibars (28.29 inches), was reported from the steamship *Tulsa*, on the evening of February 1, in connection with an area of low pressure near 42° N. and 41° W.

TABLE 1.—Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, February 1940

Station	Average pressure	Departure	Highest	Date	Lowest	Date
	<i>Millibars</i>	<i>Millibars</i>	<i>Millibars</i>		<i>Millibars</i>	
Julianehaab, Greenland ¹	996.5	-3.5	1,020	16	955	6
Reykjavik, Iceland ²	1,010.3	+9.9	1,032	12, 13	988	6
Lisbon, Portugal	1,017.6	-1.7	1,030	18	1,008	4
Horta, Azores	1,009.3	-11.7	1,027	27	991	7
Belle Isle, Newfoundland ³	999.9	-6.2	1,022	24	970	12
Halifax, Nova Scotia	1,007.6	-5.3	1,025	19	969	11
Nantucket	1,011.5	-5.8	1,029	18	970	14
Hatteras	1,014.9	-4.7	1,031	23	988	14
Turks Island	1,016.3	-2.3	1,020	23	1,011	20
Key West	1,017.3	-1.0	1,028	23	1,008	17
New Orleans	1,016.9	-2.1	1,033	22	997	17

¹ For 21 days.

² For 20 days.

³ For 24 days.

NOTE.—All data based on a. m. observations only, with departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans which are 24-hour corrected means.